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A new species of Fuziidae (Insecta, Blattida) from the Inner Mongolia, China

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Abstract

A new species attributed to the genus *Parvifuzia* Guo & Ren, 2011, *Parvifuzia peregrina* **sp. n.**, is described from the Middle Jurassic Jiulongshan Formation of Daohugou Village, Inner Mongolia, China. This new species, with apex of wing almost reaching the end of the abdomen and forewing venation with 30–32 veins at margin, broadens the diversity of *Parvifuzia*. This new species, with strongly curved cerci, could tightly clasp female and complete copulation more efficiently, same as other members of the family Fuziidae.

Keywords

Cockroach, Blattida, Fuziidae, new species, Middle Jurassic, Daohugou, China

Introduction

Fuziidae, a small extinct family, was erected by Vršanský et al. (2009). Until now, only three genera and four species have been described: *Fuzia dadao* Vršanský, Liang & Ren, 2009, *Parvifuzia marsa* Guo & Ren, 2011, *P. brava* Guo & Ren, 2011 and *Colorifuzia agenora* Wei, Liang & Ren (Vršanský et al. 2009; Guo and Ren 2011; Wei et al. in press).

This family is only found in the Middle Jurassic of China so far. It might have originated during the Triassic and became extinct in the Late Jurassic (Vršanský et al.

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2009). This family is distinguished by its unique structure of male's elongated body and forceps of earwig-like cerci (attached to the external ovipositor during courtship).

Recently we collected three well-preserved fossils of Fuziidae from Jiulongshan Formation in Daohugou Village, Ningcheng County, Inner Mongolia, China. After detailed examination, we consider these specimens belonging to the genus *Parvifuzia* based on the following features: small-sized (body length 10.4–10.6 mm and forewing length 8.5–8.8 mm); apex of cerci strongly curved inward, with a narrow gap at the center; wing venation simple; forewing R strongly curved, CuA almost straight, then curved to posterior wing margin.

Daohugou has yielded many fossil insects, animals and plants. Many insects have been found in this biota, such as Orthoptera (Gu et al. 2012), Grylloblattida (Cui et al. 2010), Mecoptera (Ren et al. 2009), Neuroptera (Wang et al. 2010), Plecoptera (Liu et al. 2008), Hemiptera (Yao et al. 2007), Hymenoptera (Shih et al. 2011), Diptera (Zhang et al. 2009), carnivorous cockroaches (Liang et al. 2009) and Ephemeroptera (Huang et al. 2008). The age of Jiulongshan Formation, although still controversial, is generally accepted as the Middle Jurassic (Bathonian-Callovian boundary interval, about 165 Mya) (Ren et al. 2002; Chen et al. 2004; Gao et al. 2006).

Material and methods

Three specimens of the new species are deposited in the fossil insect collection of the Key Laboratory of Insect Evolution & Environmental Changes, Capital Normal University, Beijing, China. The specimens were examined with a Leica MZ 12.5 dissecting microscope and illustrated with the aid of a drawing tube attached to the microscope. Line drawings were made with Photoshop CS 8.0 graphic software. Photographs of fossils were taken by a MZ12.5 dissecting microscope (Leica, Wetzlar, Germany), either dry or with alcohol.

The venation nomenclature used in this paper is based on the interpretation of Vršanský (1997, 2009). Abbreviations used: RFW- Right forewing; LFW- Left forewing; HW- Hind wing; Sc- Subcosta; R- Radius; Rs- Radius Sector; M- Media; Cu- Cubitus (A- anterior, P- posterior); A- Anal vein; Ant- Antenna.

Systematic palaeontology

Order Blattida Latreille, 1810
Superfamily Caloblattinoidea Vršanský & Ansorge in Vršanský (2000)
Family Fuziidae Vršanský, Liang & Ren, 2009

***Parvifuzia* Guo & Ren, 2011**
http://species-id.net/wiki/Parvifuzia

Type species. *Parvifuzia marsa* Guo & Ren, 2011

Other species included. *P. brava* Guo & Ren, 2011, and *P. peregrina* sp. n.

Key to species of the genus *Parvifuzia*

1 Apex of wing reaching the middle of the 8th abdominal segment..... **2**
– Apex of wing almost reaching the end of the abdomen ..... ***Parvifuzia peregrina* sp. n.**
2 Pronotum quasi-circular, not very wide; forewing M reaching the anterior margin of the wing ..... ***P. marsa* Guo & Ren, 2011**
– Pronotum wide, oval, transverse; forewing M reaching the apex margin of the wing .....***P. brava* Guo & Ren, 2011**

***Parvifuzia peregrina* Wei, Liang & Ren, sp. n.**
urn:lsid:zoobank.org:act:64133161-19F9-41EB-A9DD-0D5B94F65A52
http://species-id.net/wiki/Parvifuzia_peregrina
Figs 1–3

Diagnosis. Apex of wing almost reaching the end of the abdomen, forewing venation with 30–32 veins at margin.

Comments. *P. peregrin*a sp. n. is similar to *P. marsa* Guo & Ren, 2011 in the following aspects: small-sized; apex of cerci strongly curved inward and rounded in shape, with a narrow gap at the center; wing venation simple; forewing R strongly curved like waves, CuA almost straight, then curved to posterior wing margin, anal area wide.

However, *P. peregrin*a sp. n. can be easily differentiated from the other two previously described species: apex of wing almost reaching the end of the abdomen in *P. peregrin*a sp. n. vs. apex of wing just reaching the middle of the 8th abdominal segment; forewing length is longer (forewing length 8.5–8.8 mm in *P. peregrin*a sp. n., vs. forewing length 6.3–6.4 mm); and forewing venation with 30–32 veins at margin in *P. peregrin*a sp. n., vs. forewing venation with 25–27 veins at margin.

Description. Small-sized, body length about 10.4–10.6 mm (with head), width 2.8–3.1 mm; head small, significantly elongated (length/width= 1.4–1.6 mm/1.3–1.4 mm), antennal socket conspicuous at sides, mouthparts unclear; pronotum length 1.6–1.9 mm, width 2.3–2.7 mm, elliptical, as wide as the body; abdomen 6–7 segments visible, terminal sternum rounded; long cerci has 14 segments and apex of cerci strongly curved inward and rounded in shape, forming a narrow gap at center (Fig 3A), segments of cerci joined together after the 8th segment.

Forewings (Figs 1, 2, 3B): length range about 8.5–8.8 mm, width range about 2.6–2.9 mm; narrow, without coloration, with intercalaries and wing venation simple, with 30–32 veins at margin; costal area wide (1/3 width of the wing); Sc simple, curved upward, longer than clavus; R strongly curved like waves and with 9–14 branches, reaching the anterior wing margin; M slightly curved and with 5–7 branches, most posterior branch of M reaching wing apex; CuA almost straight to posterior wing margin and with 5–8 branches; CuP strongly curved and simple; clavus short, less than a third of the wing's length; A simple, arc bending and with about 4 veins.

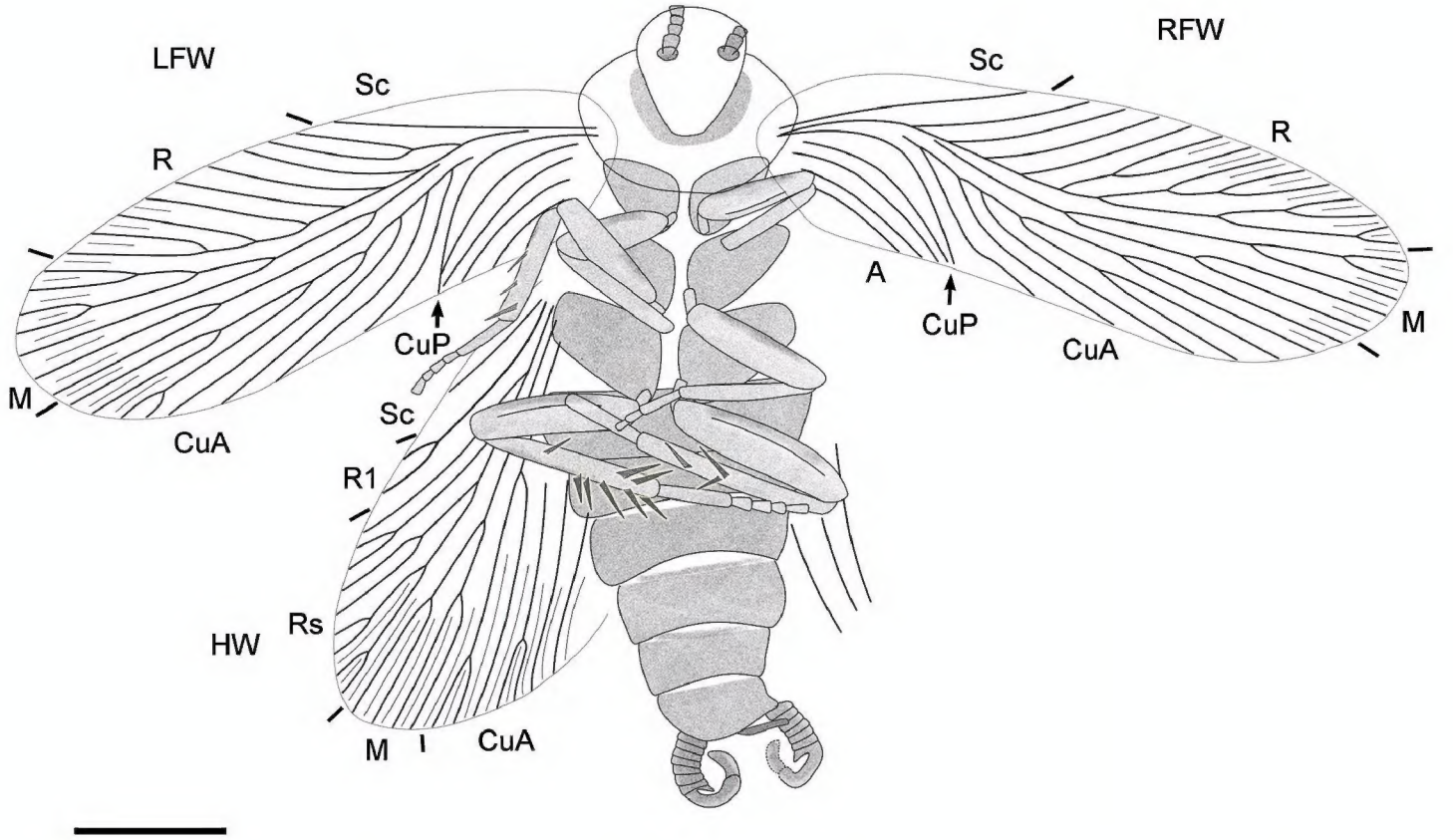

Figure 1. *Parvifuzia peregrina* sp. n. Holotype, CNU-BLA-NN-2011055; Line drawing and photograph. Scale bar = 2 mm.

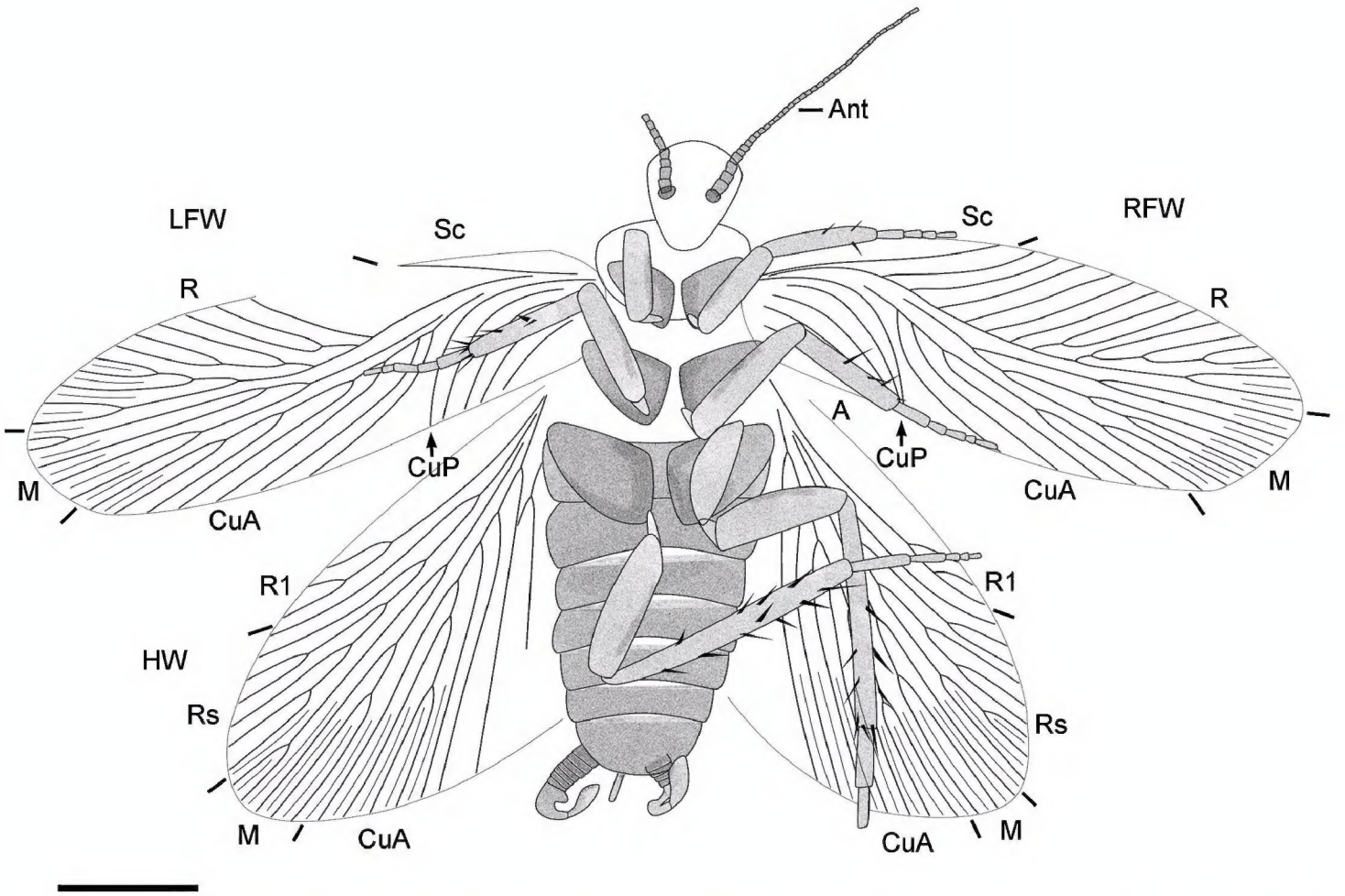

Figure 2. *Parvifuzia peregrina* sp. n. Paratype, CNU-BLA-NN-2011057; Line drawing and photograph. Scale bar = 2 mm.

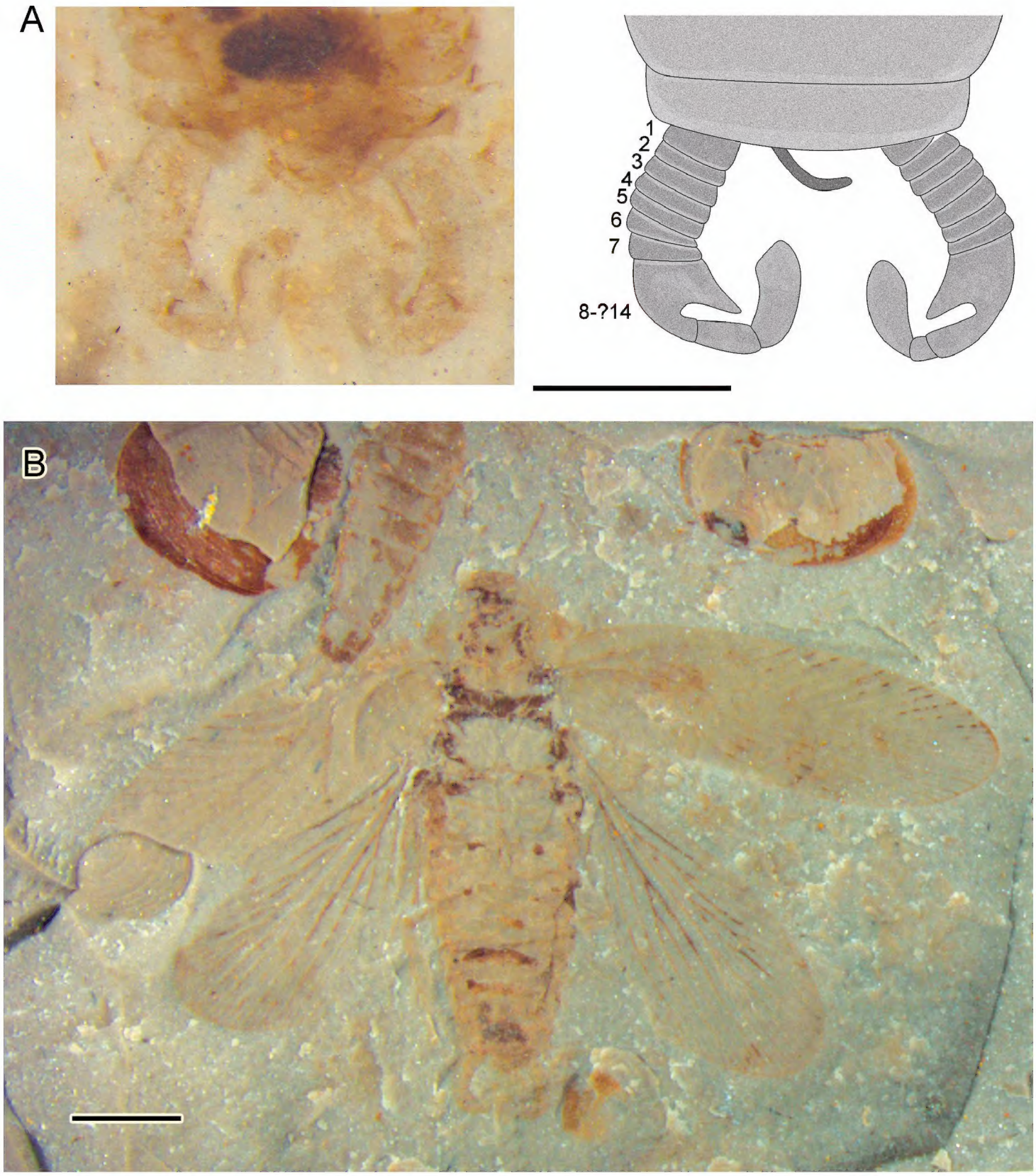

Figure 3. *Parvifuzia peregrina* sp. n. Paratype, CNU-BLA-NN-2011056 **A** Line drawing and photograph of detail of male paratype terminalia with forceps-like cerci. Scale bar = 1 mm **B** photograph. Scale bar = 2 mm.

Hind wings: length about 6.5–7.1 mm, width of remigium 2.8–3.5 mm; with intercalaries and without pterostigma; with about 22 veins of remigium; Sc simple, sometimes unclear; R terminating to wing apex, differentiated into darkened R1 with 2–3 branches and Rs with 7–9 branches; M almost straight to posterior wing margin, with 3–5 branches; CuA with about 7 branches.

Legs: length of fore femora 1.16–1.49 mm and tibiae 1.16–1.22 mm, length of mid femora 1.89–1.93 mm and tibiae 1.47–1.56 mm, length of hind femora 2.12–2.19 mm and tibiae 2.59–3.45 mm; legs gradually get longer from the front to the hind legs; mid and hind leg with spines on the tibiae.

Materials. Holotype, A completely preserved male specimen, CNU-BLA-NN-2011055. Paratypes, CNU-BLA-NN-2011056, CNU-BLA-NN-2011057.

Type locality and horizon. Jiulongshan Formation; Daohugou Village, Wuhua Township, Ningcheng County, Inner Mongolia, China; Middle Jurassic.

Etymology. The specific name is derived from the Latin word "*peregrinus*", (meaning "strange"), for this new species is special for specific characters.

Discussion

As shown in Table 1, although the total number of forewing veins of *P. peregrina* is stable, variability of the wing venation and difference between the left and right wings of the same individual are obvious. For example, the right forewing of holotype of *P. peregrina* differs from the left forewing in the following characters: (1) R with 9 branches in right forewing vs. 13 branches in left; (2) M with 7 branches in right forewing vs. 5 branches in left; (3) CuA with 8 branches in right forewing vs. 7 branches in left. We can also see the difference between the left and right wings of the paratype of *P. peregrina.*

Table 1. Variability of forewing venation for *Parvifuzia.*

Species	Number	Right forewing							Left forewing						
		Sc	R	M	CuA	CuP	A	Total	Sc	R	M	CuA	CuP	A	Tota
Parvifuzia marsa	CNU-BLA-NN-2009030	1	10	6	6	1	3	27	1	11	4	6	1	3	26
P. brava	CNU-BLA-NN-2009031	1	12	3	5	1	3	25							
P. peregrina	CNU-BLA-NN-2011055	1	9	7	8	1	4	30	1	13	5	7	1	4	31
	CNU-BLA-NN-2011057	1	11+	5	7	1	4	29+	1	14	7	5	1	4	32

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Reference

Chen W, Ji Q, Liu DY, Zhang Y, Song B, Liu XY (2004) Isotope geochronology of the fossil-bearing beds in the Daohugou area, Ningcheng, Inner Mongolia. Geological bulletin of China 23: 1165–1169. [in Chinese with English summary]

Cui YY, Béthoux O, Shih CK, Ren D (2010) A new species of the Family Juraperlidae (Insecta: Grylloblattida) from the Middle Jurassic of China. Acta Geologica Sinica (English Edition) 84: 710–713. doi: 10.1111/j.1755-6724.2010.00274.x

Gao KQ, Ren D (2006) Radiometric dating of ignimbrite from Inner Mongolia provides no indication of a post-Middle Jurassic age for the Daohugou Beds. Acta Geologica Sinica 80: 42–45. doi: 10.1111/j.1755-6724.2006.tb00793.x

Gu JJ, Z FM, Robert D, Engel MS, Qiao GX, Ren D (2012) Wing stridulation in a Jurassic katydid (Insecta, Orthoptera) Produced low-pitched musical calls to attract females. Proceedings of the National Academy of Sciences 109: 3868–3873.

Guo YX, Ren D (2011) A New Cockroach Genus of the Family Fuziidae from Northeastern China (Insecta: Blattida). Acta Geologica Sinica (English Edition) 85: 501–506. doi: 10.1111/j.1755-6724.2011.00418.x

Huang JD, Ren D, Sinitshenkova ND, Shih CK (2008) New fossil mayflies (Insecta: Ephemeroptera) from the Middle Jurassic of Daohugou, Inner Mongolia, China. Insect Science 15: 193–198. doi: 10.1111/j.1744-7917.2008.00200.x

Liang JH, Vršanský P, Ren D, Shih CK (2009) A new Jurassic carnivorous cockroach (Insecta, Blattaria, Raphidiomimidae) from the Inner Mongolia in China. Zootaxa 1974: 17–30.

Liu YS, Ren D (2008) Two new Jurassic stoneflies (Insecta: Plecoptera) from Daohugou, Inner Mongolia, China. Progress in Natural Science 18: 1039–1042. doi: 10.1016/j.pnsc.2008.03.014

Ren D, Gao KQ, Guo ZG, Ji S, Tan JJ, Song Z (2002) Stratigraphic division of the Jurassic in the Daohugou area, Ningcheng, Inner Mongolia. Geological bulletin of China 21: 584–59. [in Chinese with English abstract]

Ren D, Labandeira CC, Santiago-Blay JA, Rasnitsyn A, Shih CK, Bashkuev A, Logan MAV, Hotton CL, Dilcher D (2009) A Probable Pollination Mode Before Angiosperms: Eurasian, Long-Proboscid Scorpionflies. Science 326: 840–847. doi: 10.1126/science.1178338

Shih CK, Feng H, Ren D (2011) New fossil Heloridae and Mesoserphidae wasps (Insecta, Hymenoptera, Proctotrupoidea) from the Middle Jurassic of China. Annals of the Entomological Society of America 104: 1334–1348. doi: 10.1603/AN10194

Vršanský P (1997) Piniblattella gen. nov. — the most ancient genus of the family Blattellidae (Blattodea) from the Lower Cretaceous of Siberia. Entomological Problems 28(1): 67–79.

Vršanský P, Liang JH, Ren D (2009) Advanced morphology and behaviour of extinct earwig-like cockroaches (Blattaria: Fuziidae fam.nov.). Geologica carpathica 60: 449–462.

Wang YJ, Liu ZQ, Wang X, Shih CK, Zhao YY, S. Engel M, Ren D (2010) Ancient pinnate leaf mimesis among lacewings. Proceedings of the National Academy of Sciences 107: 16212–16215.

Wei DD, Liang JH, Ren D (in press) A new fossil genus of the Fuziidae (Insecta, Blattida) from the Middle Jurassic of Jiulongshan Formation, China. Geodiversitas.

Yao YZ, Cai WZ, Ren D (2007) The oldest known fossil plant bug (Hemiptera: Miridae), from Middle Jurassic of Inner Mongolia, China. Zootaxa 1442: 37–41.

Zhang KY, Li JH, Yang D, Ren D (2009) A new species of Archirhagio Rohdendorf, 1938 from the Middle Jurassic of Inner Mongolia of China (Diptera: Archisargidae). Zootaxa 1984: 61–65.